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Solution of a multidimensional tropical optimization problem using matrix sparsification.
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Summary: A complete solution is proposed for the problem of minimizing a function defined on vectors with elements in a tropical (idempotent) semifield. The tropical optimization problem under consideration arises, for example, when we need to find the best (in the sense of the Chebyshev metric) approximate solution to tropical vector equations and occurs in various applications, including scheduling, location, and decision-making problems. To solve the problem, the minimum value of the objective function is determined, the set of solutions is described by a system of inequalities, and one of the solutions is obtained. Thereafter, an extended set of solutions is constructed using the sparsification of the matrix of the problem, and then a complete solution in the form of a family of subsets is derived. Procedures that make it possible to reduce the number of subsets to be examined when constructing the complete solution are described. It is shown how the complete solution can be represented parametrically in a compact vector form. The solution obtained in this study generalizes known results, which are commonly reduced to deriving one solution and do not allow us to find the entire solution set. To illustrate the main results of the work, an example of numerically solving the problem in the set of three-dimensional vectors is given.

MSC:
90C20 Quadratic programming
68T20 Problem solving in the context of artificial intelligence (heuristics, search strategies, etc.)
65K10 Numerical optimization and variational techniques
15A99 Basic linear algebra

Keywords:
idempotent semifield; tropical optimization; Chebyshev approximation; complete solution; matrix sparsification

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References:
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